BEAN PRODUCTION IN SALINE SOIL IN RELATION TO POPULATION DENSITY

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INTRODUCTION

Beans are considered salt sensitive, although ayocote (*Phaseolus coccineus* L.) has been classified as intermediate between a moderately sensitive legume species (Lauchli, 1984). Immediate effects of excess salinity include reduced plant growth, especially leaf area, burning of leaf margins, chlorosis and consequent low seed yield.

Management practices may minimize yield reductions under saline conditions (Meiri and Plaut, 1985). A salinity level that causes yield reduction per plant does not necessarily reduce yield on the field level to the same extent, because the field yield is the product of stand density and yield per plant. Conventional planting density in beans was established under nonsaline conditions (Escalante and Kohashi, 1995). A change in the stand density can be obtained by changing inter-row and/or intra-row spacing. A reduced intra-row spacing did not cause plant competition and therefore increased the yield per area (Keren *et al.*, 1983). The aim of this study was evaluate the biomass and seed yield production of beans in relation to cultivar and population density under saline conditions.

MATERIALS AND METHODS

The study was conducted in Montecillo, Mex. (19 °N, 98 °W and 2250 m of altitude) of dry climate (Bs) during the rainy season. Three cultivars of bush bean *Phaseolus vulgaris* L. Bayomex, Criollo of indeterminate type, and Canario 107 of determinate type and one cultivar of *P. coccineus* L. "Ayocote" of indeterminate type, were sown at a population density of 6.25 (180 x 25 cm) and 12.50 (40 x 25 cm) plants m^{-2} on June 19, 2000 in a dry clay soil with pH 8 to 8.7, EC 7 to 14 dS m^{-1} and a percentage of exchangeable sodium of 9.73 to 37.0. When the soil is moist from rain, the EC is reduced to 2 dS m^{-1}. The Ayocote and Criollo varieties are cultivated by farmers in nonsaline regions. The origin of Bayomex and Canario 107 is the INIFAP (Agricultural Research Center). All experiments were fertilized with 100-100-00 NPK. The experimental design was a split plot with four replicates. At physiological maturity (final harvest) we evaluated: total biomass, harvest index (seed yield / total biomass) and seed yield (8% humidity) and its components.

RESULTS AND DISCUSSION

The cultivars showed differences in time to physiological maturity. It occurred at 80 and 100 days after sowing (das) para Canario and Bayomex, respectively; and at 120 das for Ayocote and Criollo. The total biomass, harvest index, and seed yield and its components showed significant differences among the cultivars, population densities and the interaction cultivar * population densities (Table 1). The highest values were shown for Bayomex and the lowest for Canario. The increase of population density increased biomass and seed yield. Bayomex at high density (12.5 plants m^{-2}) gave the highest total biomass (398.7 g m^{-2}), harvest index (0.61) and seed yield

(243.3 g m^{-2}); Canario at low density (6.25 plants m^{-2}) gave the lowest values with 64 g m^{-2}, 0.45; and 28.6 g m^{-2}, respectively. The changes in the seed yield were related with changes in its components (Table 1).

These results suggest that it possible to increase the production of beans in this region by the management of population density, particularly reduced inter row spacing, under saline conditions.

Table 1. Biomass, harvest index and seed yield and its components for *Phaseolus vulgaris* L. and *P. coccineus* L., at physiological maturity, in relation to cultivar and population density. Montecillo Mex. MEXICO. Summer 2000.

Treatments		Dry Weight 100 Seeds (g)	Number (m^{-2}) of:				Dry weight (g m^{-2}) of:				Biomass	Harvest index
V	D		Normal Seeds	Pods with seed	Nodes	Racemes	Pericarp	Stem	Normal seeds	Empty seeds		
Bayomex	6.25	26.2c	432.9bc	118.0b	200.1c	106c	38.9bc	53.3	115.0bc	0.74	208.0bc	0.53ab
	12.50	27.3c	877.6a	211.4a	462.3a	222.5a	77.6a	76.9	243.3a	0.92	398.7a	0.61a
Ayocote	6.25	53.2b	225.2d	102.3b	150.0cd	104.8c	55.9b	112.3	120.0bc	0.60	288.8bc	0.41bc
	12.50	65.6a	230.5d	107.5b	308.8b	108.4c	48.8b	115.2	151.2b	0.89	316.1b	0.48bc
Canario	6.25	19.4c	157.7d	41.3c	89.6d	46.1d	15.4d	18.5	28.6d	1.45	64.0d	.45bcd
	12.50	23.0c	310.8bcd	104.6b	209.7bc	100.4c	37.3bc	35.0	73.2cd	2.59	148.1cd	0.49bc
Criollo	6.25	23.2c	271.1cd	97.9b	173.4cd	95.4c	25.1cd	75.4	62.6cd	0.83	164.0cd	0.36d
	12.50	23.7c	453.1b	139.7b	497.8a	148.3b	42.4bc	97.4	109.5bc	0.94	250.2bc	0.43cd
V		***(5.0)	***(107.7)	***(30.2)	***(65.1)	***(18.8)	***(12.7)	***(23.4)	***(37.2)	*(0.9)	***(65.7)	***(0.06)
D		NS	***(57.7)	***(16.2)	***(34.9)	***(10.1)	***(6.8)	**(12.5)	***(19.9)	NS	***(35.2)	***(0.03)
V*D		***(8.4)	***(179)	***(50)	***(108)	***(31)	***(21)	NS	***(62)	NS	***(109)	*(0.09)

D= Population density (plants m^{-2}). In the column values with different letters are statistically different; *P≤0.05, ** P≤0.01,*** P≤0.001, NS=No significant; Tukey 0.05 inside parentheses. V = cultivar.

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